What is
momentum?
Impulse?
Law of conservation of momentum (include assumptions)

Momentum, p, is the product of mass and velocity.
$p=mv$
it is a vector quantity (next class - vector diagrams)
units: kgm/s (atomic level? MeV/c)

Impulse: the change in momentum caused by a net force over a period of time.

$\Delta p=F_{net}\,\Delta t$ original form of Newton's second Law

$F_{net} = \Delta p/\Delta t$ slope of p-t graph if F_{net}
therefore, the area under the F_{net} - t graph is Δp

($F_{net}=ma$ is not used for rocket or relativistic problems)

Law of conservation of momentum:
The vector sum of all the momentum vectors of all the objects in a system is conserved through collisions and explosions assuming a closed, isolated system.
(no objects in/out and no unbalanced external forces)

eg. a 1.0 kg cart is rolling at 3.0 m/s when it collides

with a 2.0 kg cart at rest.

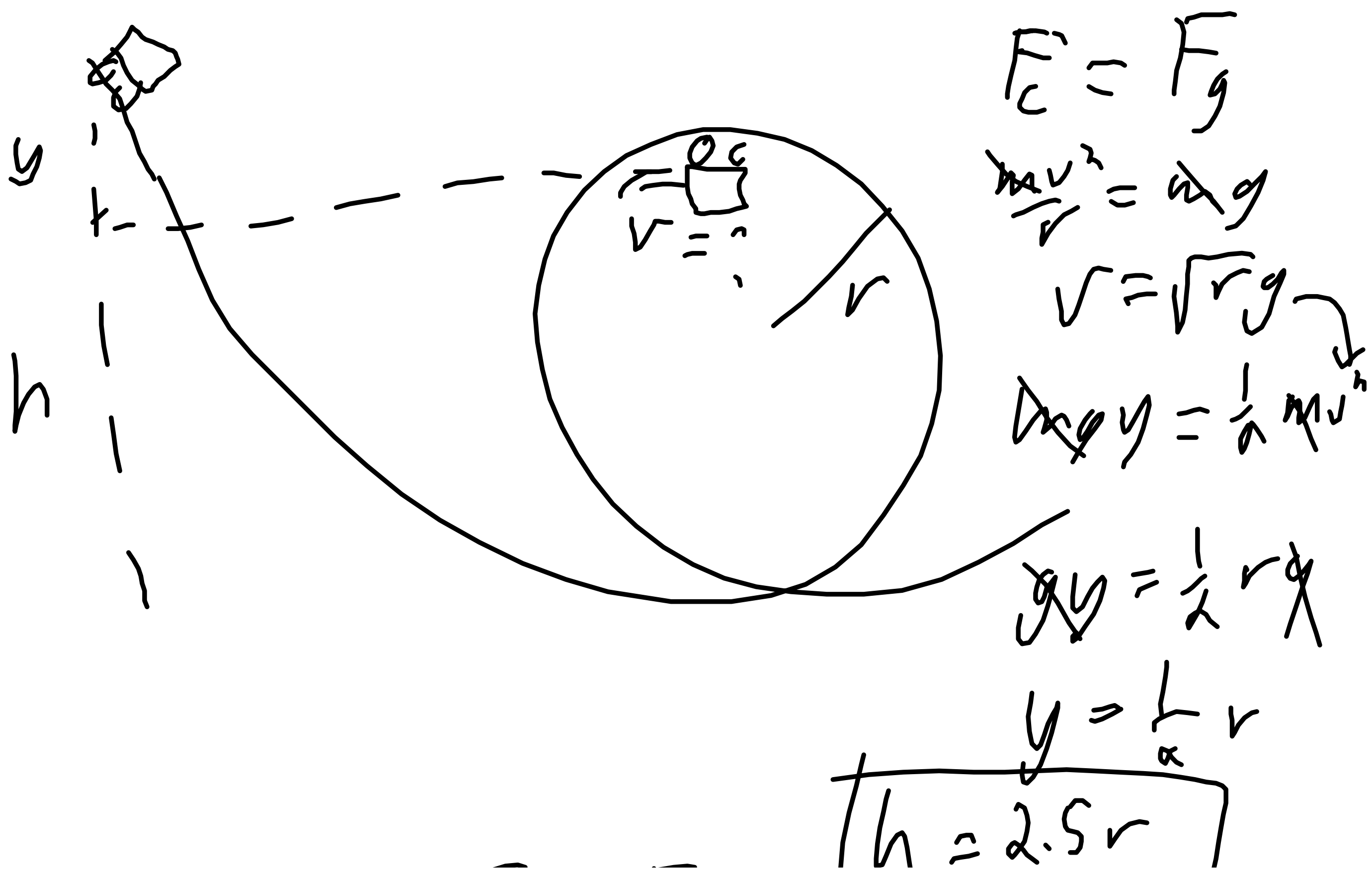
a) if they stick together, what is their velocity after the perfectly inelastic collision?

b) if the 1.0 kg cart bounces back at -1.0 m/s, what is the velocity of the 2.0 kg cart? Was the collision perfectly elastic?

c) What would be the speeds after the collision if it was perfectly elastic?

d) for question b) if the carts are in contact for 0.40s, what is the average force on each cart? If the force increases and decreases linearly, sketch the F-t graph. keeners if the force increases and decreases sinusoidally, sketch the F-t graph.

e) preview: A 1.0 kg bomb explodes into 3 pieces, 0.20 kg goes north at 10.0 m/s, 0.40 kg goes 30.0º South of East at 14.0m/s, what is the velocity (magnitude and direction) of the 3rd piece?



$h = 2.5r$

$F_g = F_c$

$$\frac{GMm}{r^2} = \frac{m4\pi^2 r}{T^2}$$

$$T^2 = \frac{4\pi^2 r^3}{GM}$$

$$r = \sqrt[3]{\frac{GMT^2}{4\pi^2}}$$

$$P = \frac{W}{t} = \frac{Fd}{t} = Fv$$

$F = mgv =$

$\text{area} = W = \Delta E_k = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$200J = \frac{1}{2} 8 v^2$

$v = 7.1 m/s$

$\underline{v = 6.1 \, m/s}$

$$eff = \frac{E_{out}}{E_{in}} \times 100\% = \frac{21-14\,000}{18000} = 39\%$$